REMARKS

In response to the Office Action mailed August 9, 1999, Applicants amend their application and request reconsideration. In this Amendment, claims 11-16 are cancelled and new claims 17-23 are added, which are fully supported by the original specification. The background portion of the specification has been amended for improved clarity as explained below. No new matter has been introduced.

The Examiner rejected claims 11-16. Claims 11-16 have now been canceled. Some of these claims were also the basis of the Examiner's objections to the drawings. The cancellation of these claims is presumed to render moot the drawing objections that were made, aside from informalities.

Applicants acknowledge the present informality of the drawings and plan to provide formal drawings when the allowable matter of the Application has been determined.

The Examiner rejected all remaining claims 1-10 as being anticipated by Lebby et al. in U.S. Patent No. 5,218,465, under either 35 U.S.C. 102(b) or 35 U.S.C. 103(a).

In reviewing the previous correspondence related to this Application, Applicants' Agent has observed that there has been a fundamental misunderstanding about the very context and circumstances wherein Applicants' invention is to be applied. It is believed that a brief explanation here will aid the Examiner in applying the Graham factual inquiries.

Line protect switching (LPS) is used where multiple links are implemented between a pair of nodes. The collective set of links interconnecting a given pair of nodes is referred to as a "span." In accordance with an LPS scheme, some links in a span are designated as "working" links that normally carry communications traffic, whereas other

links are designated as "spare" or "protect" links to be used as an alternate if one of the working links fails. Usually, only a small proportion of the links in a span are designated as spare because the spare link is costly yet does not yield any revenue under normal conditions. It is common to use only one spare link to protect several working links in a given span. The likelihood of having more than one working link failed at any one time is a factor in determining an acceptable the ratio of working links to spare links.

LPS may be used to protect against sudden outage of a fiber optic link that is carrying communications traffic. If a fiber is cut or a line amplifier fails, the Line Terminal Equipment (LTE) at either end of the failed link can cause the interrupted traffic to be modulated by a different transmitter, sent over a different fiber and received at a different receiver, thus bypassing the failed link until repairs can be effected.

LPS may be also used to protect against a "facility" failure, meaning the sudden failure of either a transmitter or receiver at either end of an optical link. By switching traffic to a different set of transmitter, fiber, and receiver, the facility failure is effectively circumvented until repairs can be performed.

LPS is local, simple to control, and operates very quickly to minimize duration of an outage within a span. But it should be noted that if all of the links in a span should fail, as may happen due to a fiber cable cut, no extent of line protect switching measures can restore communications between the associated pair of adjacent nodes.

To restore communications in response to a span cut, a network restoration switching (NRS) approach must be applied wherein the traffic that was interrupted between a given pair of nodes is rerouted through other nodes and spans in the network. One technique for such a "self-healing" network of nodes is described by Grover in U.S. Patent No. 4,956,835, which was incorporated by reference in the Application. In response to a span cut, a self-healing network of nodes finds as many alternate routes as are needed and are available to reroute all of the failed traffic and circumvent the failed span entirely. NRS techniques are generally more complex and slower than LPS

techniques, but address failures on a broader scale than LPS. NRS and LPS mechanisms are often used together in a complementary fashion within a given network because they solve problems of different scope and operate in different time frames following a failure.

Applicants' invention arises in the context of a network of optical crossconnect switches. Referring to Figure 4A of Applicants' drawings, OCCS 108 and OCCS 112 are just two cross-connect switches in a network of switches, the remainder of which are represented by optical restoration network 110. On page 13, lines 10-17, the Application clearly establishes this context of a network of other peer optical cross-connect switches and optical links analogous to the two optical cross-connects and five links explicitly shown in Figure 4A.

In their invention, Applicants' have recognized that multiple concurrent failures may impact a given span, possibly exceeding the number of protect links available to recover by using LPS alone. Rather than adding costly spare links to improve robustness, Applicants' propose a coordinated action between LPS and NRS mechanisms so that NRS can lend distributed spare links to improving the robustness of a span even when there is not a catastrophic failure of the entire span.

Applicant's have further realized a particular aspect to applying an NRS technique among a network of optical cross-connect switches. In this context, NRS alone is not adequate to restore a failed transmitter, for example, because there is no extra transmitter separately coupled to the optical cross-connect network that can originate an optical carrier. Referring to Figure 4A of Applicant's drawings, facility 206B may be a transmitter, for example. If facility 206B fails and can no longer transmit an optical carrier, then no actions by OCCS 108, OCCS 112, nor the remainder of the OCCS network 110 can restore the interrupted traffic that was formerly sent along line 214B. Only the LPS mechanism involving protect facility 204 can be used to circumvent failed facility 206B. Of course, if protect facility 204 is already involved in recovering from a line failure, then some traffic will be unrestorable by the approaches of the prior art.

Applicants' invention provides for a novel method whereby a first traffic stream that is occupying the protect link due to a line failure may be preempted by a second traffic stream that is interrupted by a subsequent facility failure. Because the second traffic stream can only be restored by occupying the protect link via LPS, the first traffic stream is displaced to be restored by coordinated switching among the cross-connect switches using the NRS mechanism. This behavior is described in the process steps of Applicants' Figure 3 and is also well summarized in the Application on page 5, starting at line 23.

The Examiner is invited to review the Application even without the amendments submitted herewith. It is believed that the Examiner will be satisfied that all of the explanation above is consistent with and may be adequately supported by Applicants' specification. The specification has been amended herein to better clarify both the technical context and prior art context of Applicants' invention, in particular the distinction between the well known practices of line protect switching and network restorative switching.

The amendments to the background portion of the Application establishing the context of the invention are in complete agreement with what was put forth in the original Application and introduce no substantive new matter.

Turning now to the outstanding Office Action, the Examiner's has cited the patent to Lebby et.al.(Lebby) as anticipating claims 1-3, 8-9, plus other claims that have now been cancelled. Applicants' respectfully assert that Lebby only describes and is only concerned with restoring communications within a single span between two sites. In essence, Lebby teaches a variation upon line protect switching, i.e. upon failure of one link, switching traffic to an alternate link along the same span (Col.5, Line 31). Note that Lebby uses the terms "path" and "link" interchangeably in many places and that Lebby uses "optical channel" (Col. 3. Line 53) to mean the set of links between two nodes, i.e. a "span" as it is more commonly known in the industry. Even though Lebby mentions that line protect switching may implemented within optical switches (Col 3, Line 60) as an

alternative to the electrical domain cross-connects switches shown, there is no suggestion that a separate network restoration mechanism exists or that spare resources outside of the immediate span are employed to help with restoring a link or facility failure. Therefore, upon review of the disclosure by Lebby, one of ordinary skill in the art would not further assume that an inter-nodal network restoration scheme existed nor that a restoration mechanism outside of the immediate span would respond in any way to a local facility failure.

Consequently, many limitations in Applicants' claims are not found or are in any way suggested or contemplated by Lebby.

For example, Applicants' independent claim 1 recites in one element that "when it is determined ... that said protect channel is restoring one of the one or more previous failures, sending a notification of the subsequent failure to an optical cross-connect switch controller." This refers to the escalation of the failure to the cross-connect restoration network once the LPS has already been applied to restoring a previous failure.

Applicants' independent claim 2 recites the steps of "receiving a notification of the subsequent failure, wherein said notification includes a failed facility type that caused the subsequent failure" and "determining whether the subsequent failure is restorable via an optical cross-connect switch." In the Lebby patent, there is no differentiation of failed facility type as taught by Applicants nor any decisions about whether to use an NRS or LPS mechanism to restore a particular failure incidence. NRS is not an option contemplated in Lebby. Thus, there is no comparison in Lebby of a previous failure type to a subsequent failure type to determine which failure should be restored by which mechanism, LPS or NRS. Consequently, Lebby does not teach even the step of communicating a failure type in support of making such decisions. Claim 2 is therefore patentably distinct from Lebby and, as claims 3-10 depend from claim 2 and include the limitations thereof, they are also patentable over Lebby.

Of particular note, dependent claim 9 recites the limitations of "restoring one of the one or more previous failures that was restored on a protect channel via said optical cross connect switch; and restoring the subsequent failure via said protect channel." These limitations refer to the preemption of a line failure already occupying the protect channel in order to restore a facility failure, causing the line failure to be restored through a network of optical cross-connect switches external to the immediate span. None of the prior art cited or relied upon suggests this aspect of Applicants' teachings.

In summary, based upon these novel aspects being incorporated into the claims, Applicants respectfully traverse the Examiner's rejection of claims 1-3 and 8-9 made under 35 U.S.C. 102(b).

Likewise, regarding the rejection of claims 4-7 and 10 under 35 U.S.C.103(a), it has been shown that the claims at issue are substantially different from any teachings in Lebby et al. and from any other knowledge held by those of ordinary skill in the art when the invention was made. The traditional understanding is that LPS and NRS operate in different parts of a network and serve separate yet complementary roles. In none of the cited references is there any indication of the existence of a restoration network beyond the immediate span, let alone any specific suggestion of coordination between such a restoration network and locally applied LPS in response to a module failure. Therefore, Applicants respectfully traverse the Examiner's rejection of the claims at issue based on Lebby and made under 35 U.S.C. 103(a).

Applicants' Agent has reviewed the other references cited and found that none of the references allude to any form of restoration abilities beyond the local span, much less do they describe or suggest any form of coordination between LPS and NRS mechanisms.

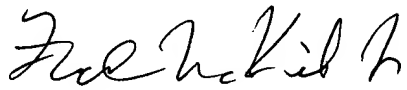
Applicants have added new claims based upon the adequately disclosed and enabled method of displacing a line failure from a protect channel so that a facility failure may be overcome.

CONCLUSION

All of the stated grounds of rejection have been properly traversed, accommodated, or rendered moot. Applicants therefore respectfully request that the Examiner reconsider all presently outstanding objections and rejections and that they be withdrawn. Applicants believe that a full and complete response has been made to the outstanding Office Action and, as such, the present application is in condition for allowance. If the Examiner believes for any reason that personal communication will expedite prosecution of this application, the Examiner is invited to telephone the undersigned at the number provided.

Prompt and favorable consideration of this Amendment is respectfully requested.

Respectfully submitted,



Frank McKiel, Jr.
Agent for Applicants
Registration No. 43,792

Date: June 8, 2000

2424 Garden of the Gods Road
Colorado Springs, CO 80919
(719) 535-6307